

REMARKS

Following the filing of an Appeal Brief, prosecution of the present application was reopened and new grounds of rejection were presented. In this regard, Claims 1, 2, 4 and 10-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,882,823 to Edward D. Weisert, et al. in view of an article by G.A. Salishachev, et al. entitled "Characterization of Submicron-Grained Ti-6Al-4V Sheets with Enhanced Superplastic Properties" and a published PCT application bearing Publication No. WO 95/13406 to Boris B. Movchan, et al. Additionally, Claims 5-9, 16-23 and 36-42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Weisert '823 patent in view of the Salishachev article, the Movchan '406 publication and U.S. Patent No. 5,118,026 to George W. Stacher. As explained in detail below, independent Claims 1, 16 and 36 have been amended to further patentably distinguish the claimed invention from the cited references, taken either individually or in combination. Based upon the amendments to the independent claims, dependent Claims 4 and 37 have been cancelled and dependent Claim 38 has been amended for purposes of consistency. Additionally, new dependent Claims 45 and 46 have been added to further define in the grain size of the second blank in some embodiments. Based on the foregoing amendments and the following remarks, reconsideration of the present application and allowance of the amended set of claims are respectfully requested.

Applicants' undersigned representative also wishes to thank the Examiner for the courtesies extended during the telephonic interview on June 10, 2008. In the interview, the amendments to the independent claims were discussed, along with the support for such amendments and the cited references including, in particular, the Salishachev article and the Stacher '026 patent. During the interview, it was agreed that the amendments appeared to overcome the rejections and further consideration would be given upon submission of this written response.

Amended independent Claim 1 describes a method for superplastically forming blanks to produce a first structural member having a predetermined configuration. As amended, the method provides first and second blanks formed of titanium with the first blank having a grain size of between 0.8 and 1.2 microns and the second blank having a grain size greater than 2 microns. Each blank is then heated to within a diffusion bonding temperature range. The first

blank is then diffusion bonded to the second blank at a diffusion bonding temperature of less than 1450°F. The bonded blanks are then heated to within a superplastic forming temperature range of the blanks. The bonded blanks are then superplastically formed at a forming temperature of less than 1450°F to produce a structural member having the predetermined configuration. By performing the diffusion bonding and superplastic formation at reduced temperatures, numerous advantages are obtained including processing efficiency, energy conservation, reduction of die wear, etc.

Amended independent Claim 36 includes the recitations of independent Claim 1 and further defines the superplastic forming of the bonded blanks to be carried out at a strain rate of at least about 6×10^{-4} per second. As amended, independent Claim 36 also notes that during the superplastic forming of the bonded blanks, a layer of alpha case oxide is formed on each surface of the structural member. As such, the method of amended independent Claim 36 also pickles the structural member following superplastic forming of the bonded blanks to remove the alpha case oxide layer. See, for example, paragraphs [0036]-[0038] of the published application for a discussion of the formation of the alpha case oxide and the subsequent pickling process.

Further, although amended independent Claim 16 does not specify the respective grain sizes of the first and second blanks, Claim 16 otherwise includes the recitations of independent Claim 1 and further defines the first and second blanks to be formed of Ti-6Al-4V. Additionally, independent Claim 16 recites that a layer of alpha case oxide is formed during the superplastic forming of the bonded blanks that is less than about 0.001 inch in thickness on each surface of the structural member and then further recites that the structural member is pickled following superplastically forming the bonded blanks to remove the alpha case oxide.

As now amended, independent Claims 1 and 36 both describe the diffusion bonding of a first blank comprising a fine grain titanium material, that is, a titanium material having a grain size between 0.8 microns and 1.2 microns, and a second blank comprising a conventional titanium material, that is, a titanium material having a grain size larger than 2 microns. Although the Weisert '823 patent describes a superplastic forming diffusion bonding process for titanium members, the Weisert '823 patent does not describe the grain sizes of the titanium members. Instead, the Official Action relies upon the Salishachev article for its disclosure of the superplastic forming and superplastic forming/diffusion bonding of Ti-6Al-4V sheets having a

submicron grain size, that is, a grain size less than 1 micron. None of the references, however, including the Salishachev article teach or suggest diffusion bonding a first blank comprising a fine grain titanium material having a grain size of between 0.8 microns and 1.2 microns and a second blank comprising a more conventionally grained titanium material having a grain size of greater than 2 microns at a diffusion bonding temperature of less than 1450°F, as now set forth by amended independent Claims 1 and 36. As described by paragraphs [0039] and [0040] of the published application, the diffusion bonding of a fine grain titanium member to a conventional titanium member at lower diffusion bonding temperatures than those required by conventional titanium material was unique. In this regard, the first sentence of paragraph [0039] states:

“It has also been discovered that articles of the fine grain titanium materials described in the present invention can be diffusion bonded to conventional materials at temperatures less than those typically requested diffusion bonding the same conventional materials.”

While the Weisert ‘823 patent is silent as to the grain size of the titanium members that are being superplastically formed and diffusion bonded, the Salishachev article describes only the superplastic forming and diffusion bonding of titanium sheets that each have grain sizes of less than 1 micron such that none of the cited references and, therefore, no combination of the cited references teaches or suggests providing a first blank comprising titanium having a grain size of between 0.8 microns and 1.2 microns and a second blank comprising titanium having a grain size of greater than 2 microns and then subsequently diffusion bonding the first and second blanks to one another at a diffusion bonding temperature of less than 1450°F, as now set forth by amended independent Claims 1 and 36.

As described above, amended independent Claims 16 and 36 also describe the formation of a layer of alpha case oxide on each surface of the structural member and the subsequent pickling of the structural member following the superplastic formation of the bonded blanks to remove the alpha case oxide layer. In this regard, the Official Action notes that the Weisert ‘823 patent, the Salishachev article and the Movchan ‘406 publication all fail to disclose pickling the surface of a workpiece to remove oxide formed during a superplastic forming step. See page 6 of the Official Action. However, the Official Action asserts that the Stacher ‘026 patent “teaches that the surfaces require preparatory cleaning (i.e., pickling) (col. 2, lines 45-47) and states that

further application of pressure breaks up the surface oxide to present clean surfaces for bonding (col. 2, lines 53-55).” *Id.* The Official Action continues by stating that it would have been obvious to one of ordinary skill in the art to have combined the pickling step of Stacher with the combined disclosures of the Weisert ‘823 patent, the Salishachev article and the Movchan ‘406 publication “in order to remove an accurate amount of oxide to obtain the maximum obtainable joint strength (Stacher: col. 2, lines 50-53) and to significantly lower the cost, difficulty, and time involved in the diffusion bonding and superplastic forming titanium alloy structures (Stacher: col. 3, lines 30-36).” *Id.*

Notably, the independent claims recite the pickling of the structural member following the superplastic formation of the bonded blanks to remove the alpha case oxide layer. In contrast, the Official Action does not even assert that the Stacher ‘026 patent disposes pickling a structural member to remove alpha case oxide that is formed thereon during a superplastic forming step, as set forth by amended independent Claims 16 and 36. In contrast, the Official Action asserts that the preparatory cleaning of the Stacher ‘026 patent corresponds to the recited pickling operation. However, independent Claims 16 and 36 have been amended to explicitly state that the pickling of the structural member occurs “following superplastically forming the bonded blanks” to remove the alpha case oxide formed during the superplastic forming operation. Amended independent Claims 16 and 36 are therefore even more clearly patentably distinct from the cited references, including the Stacher ‘026 patent – none of which teach or suggest pickling the structural member after a superplastic forming operation in order to remove the alpha case oxide layer.

Moreover, as the preparatory cleaning of the Stacher ‘026 patent is performed in order to present clean surfaces for a subsequent bonding operation, it is submitted that a person of ordinary skill in the art would not have been motivated to preform the claimed pickling step after both a diffusion bonding operation and a superplastic forming operation to remove the alpha case oxide formed during the superplastic forming operation. As noted above, page 6 of the Official Action suggests that one of ordinary skill in the art would have been motivated to have performed the preparatory cleaning of the Stacher ‘026 patent in order “to significantly lower the cost, difficulty, and time involved in the diffusion bonding and superplastic forming titanium alloy structures.” This supposed motivation is misplaced, however, since the amended

independent claims make it clear that the pickling occurs after the diffusion bonding and superplastic forming such that post SPF/DB pickling would have no impact upon the cost, difficulty and time involved in the diffusion bonding and superplastic forming operations.

Since none of the cited references, taken either individually or in combination, teach or suggest: (i) diffusion bonding a fine grained titanium blank to a conventionally grained titanium blank at a temperature of less than 1450°F; and (ii) pickling the structural member following superplastic formation of the bonded blanks to remove the alpha case oxide layer formed thereon during the superplastic formation operation, it is submitted that the rejection of independent Claims 1, 16 and 36, as amended, as well as the claims which depend therefrom, is therefore overcome.

CONCLUSION

In view of the claim amendments presented above, Applicant submits that the present application is in condition for allowance. As such, the issuance of a Notice of Allowance is therefore respectfully requested. In order to expedite the examination of the present application, the Examiner is encouraged to contact Applicant's undersigned attorney in order to resolve any remaining issues.

The patentability of the independent claims has been argued as set forth above and thus Applicants will not take this opportunity to argue the merits of the rejection with regard to the dependent claims. However, Applicants do not concede that the dependent claims are not independently patentable and reserve the right to argue the patentability of the dependent claims at a later date if necessary.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,



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